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Teletext receivers

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| held in N-page memory ? |
| channel number |
| page number |

55

Fig 2.

←——— 'A' section ———→ ←——— 'B' section ———→

150

channel no.

page no.

s.f. value

A_1 A_3 A_{n-2} A_n B_1 B_3 B_m

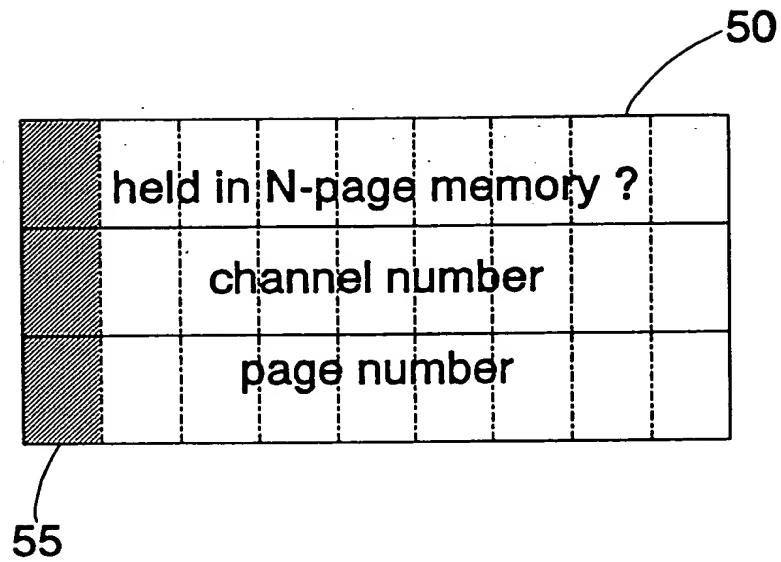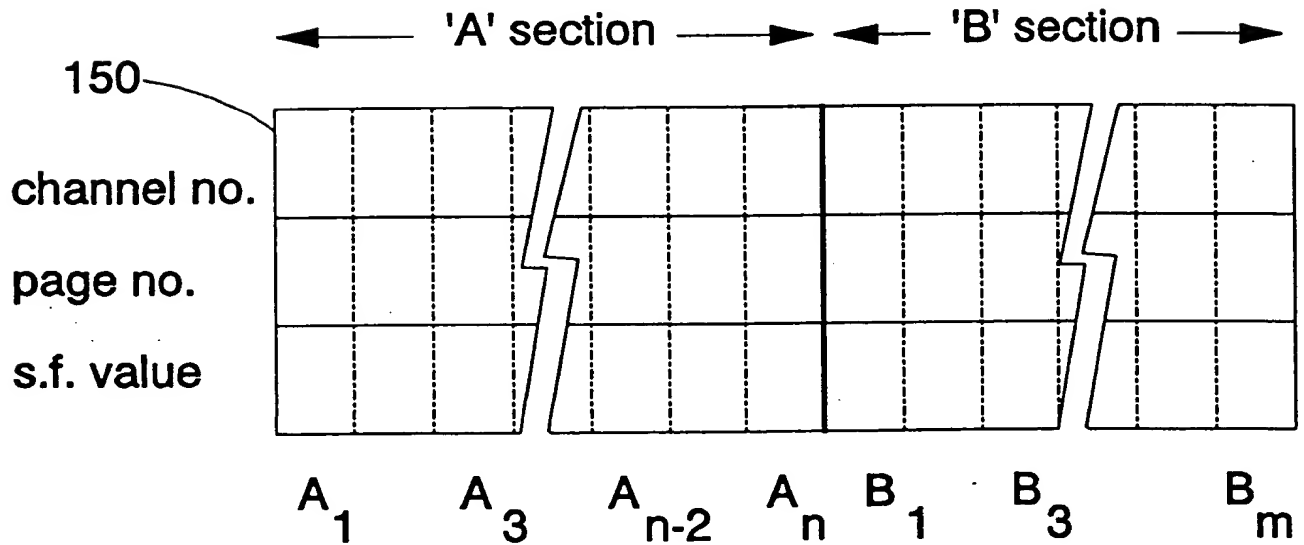*Fig 3.*

This invention provides a teletext receiver in which teletext pages demultiplexed from a video signal are displayed in response to user selection of corresponding page identifiers, the receiver comprising:

5   means for storing information indicative of the relative frequency of user selection of the page identifiers;

selection frequency detecting means for detecting a predetermined number of most frequently selected page identifiers;

a page memory for storing teletext pages corresponding to the

10   most frequently selected page identifiers; and

means, responsive to user selection of a page identifier for which the corresponding teletext page is stored in the page memory, for retrieving that teletext page from the page memory for display;

the means for storing comprising:

15   a first memory section and a second memory section each having a plurality of entries, each entry being operable to store a page identifier and a selection frequency value associated with that page identifier;

means, responsive to user selection of a page identifier stored

20   in an entry in the first memory section or the second memory section, for incrementing the selection frequency value associated with the selected page identifier;

means, responsive to user selection of a page identifier not stored in an entry in the first memory section or the second memory

25   section, for storing that page identifier in an entry in the second memory section, overwriting the least recently stored page identifier in the second memory section; and

means, responsive to a detection that an entry in the first memory section has a lower selection frequency value than an entry in

30   the second memory section, for exchanging that entry in the first memory section with that entry in the second memory section.

The invention solves, or at least alleviates, the problem of a time delay between page selection and display, by providing a teletext receiver having a page memory operable to store a predetermined number

35   of pages which are most frequently selected by the user of that particular teletext receiver. This contrasts with, for example, the Fastext system which relies on page selection frequencies appropriate

identical to a page identifier in the list of page identifiers; and means for setting the storage flag associated with that page identifier to indicate that the currently demultiplexed teletext page has been stored in the page memory.

5   Although, for example, page numbers alone could be used as the page identifiers, it is preferred that each of the page identifiers comprises a page number and a television channel number (although the television channel number selected by the user may well remain constant for several successively selected page numbers).   In this case,

10   although the most frequently selected pages from any channel could be detected and stored, in order to use the page memory efficiently it is preferred that the selection frequency detecting means is operable to detect the predetermined number of most frequently selected page identifiers for a currently received television channel.

15   Viewed from a second aspect this invention provides a teletext decoder operable to receive teletext pages demultiplexed from a video signal and to output teletext pages for display in response to a user selection of corresponding page identifiers, the decoder comprising:

        means for storing information indicative of the relative

20   frequency of user selection of the page identifiers;

        selection frequency detecting means for detecting a predetermined number of most frequently selected page identifiers;

        a page memory for storing teletext pages corresponding to the most frequently selected page identifiers; and

25   means, responsive to user selection of a page identifier for which the corresponding teletext page is stored in the page memory, operable to retrieve that teletext page from the page memory and to output that teletext page for display;

        the means for storing comprising:

30   a first memory section and a second memory section each having a plurality of entries, each entry being operable to store a page identifier and a selection frequency value associated with that page identifier;

        means, responsive to user selection of a page identifier stored

35   in an entry in the first memory section or the second memory section, for incrementing the selection frequency value associated with the selected page identifier;

in response to a detection that an entry in the first memory section has a lower selection frequency value than an entry in the second memory section, exchanging that entry in the first memory section with that entry in the second memory section.

5   The invention will now be described by way of example with reference to the accompanying drawings, throughout which like parts are referred to by like references, and in which:

Figure 1 is a schematic block diagram of a teletext receiver;

Figure 2 is a schematic diagram of a page list store; and

10   Figure 3 is a schematic diagram of a page selection memory.

Of the above Figures, Figure 2 is included as technical background and to provide a comparison with the embodiment of Figure 3.

Figure 1 is a schematic block diagram of a teletext receiver in which a teletext demultiplexer 10 receives a television (TV) signal and

15   demultiplexes teletext information from that TV signal. At any time either (or both) of the demultiplexed teletext information and conventional picture information derived from the TV signal may be displayed by the teletext receiver.

As described above, teletext pages are received serially in video

20   lines of the vertical blanking interval of the television signal. Each page takes about 0.06 seconds to transmit, and includes a page header row which specifies a page number associated with that page. The teletext demultiplexer 10 provides three output signals: a current channel identifier specifying the TV channel currently being received;

25   a current teletext page number derived from the header row of the currently received page; and the serial teletext page data themselves.

A page selector 20 is responsive to user control (for example by means of a handset or remote commander) to output a page number selected by the user, a television channel number selected by the user

30   (which may well be constant for several successive page numbers), and a selection signal indicating that a new page or channel selection has been made. The three outputs of the page selector 20 are supplied as inputs to a page selection memory 30, which stores the relative frequency of selection of the available teletext pages. The page

35   selection memory 30 is a non-volatile random access memory (RAM) having a large number of address locations, each capable of storing a multi-

for that page (a period of about 9 microseconds). If the current channel number and current page number match an entry in the page list, the write comparator sets a write enable ("WE") flag to control writing of the current page data into the N-page memory 60. The write comparator also sets a "stored" flag associated with that entry in the page list to indicate that the page data have been stored.

The list store 50 and the N-page memory 60 may comprise volatile or non-volatile memories. If non-volatile memories are used, then there will be page data stored for immediate access when the receiver is first switched on, although those data will relate to pages received when the receiver was last used.

Each teletext page comprises 24 rows of 40 characters of text, a total of 960 characters. This means that about one kilobyte (1024 bytes) of memory is sufficient to store a complete page along with any page identification data. The N-page memory 60 can thus be implemented as an N-kilobyte RAM.

Data representing a page to be displayed are stored in a display memory 80. In order to display a page selected by the user, either page data retrieved from the N-page memory 60 or currently received page data are written into the display memory 80, depending on whether the selected page is one of the N most frequently selected pages stored in the N-page memory 60. Reading from the display memory 80 is performed continually in accordance with the scanning of an output display device such as a cathode ray tube.

A read comparator 90 receives the selected page number from the page selector 20 and compares this with the entries in the list store 50. If that page number is held in the list store 50 and the "stored" flag associated with that page number is set (to indicate that the page has been stored in the N-page memory 60) the read comparator 90 sets a read enable ("RE") signal to control reading of that page from the N-page memory 60. The read enable signal also performs two other functions: it controls a switch 110 to select the output of the N-page memory 60 as a data input to the display memory 80, and it is supplied as an input to an OR-gate 120 to generate a write enable signal to control writing into the display memory 80.

If the selected page number is not held in the list store 50, or if the respective "stored" flag is not set (indicating that that page

is chosen to be larger than the number of different pages normally accessed by a typical user.

When a new teletext page is selected, if that page number and channel number already exist in either the A section or the B section of the page selection memory 150, then the selection frequency value at that location is incremented. However, if the page number and channel number combination do not exist in the page selection memory then the data stored in the location B_m are discarded, the data stored at location B_{m-1} are moved to location B_m, the data stored at the location B_{m-2} are moved to the location B_{m-1} and so on, until the newly selected page number and channel number combination may be written to the free location B_1. In this way the newly selected page number and channel number overwrite the least recently written page number and channel number combination in the B section of the page selection memory 150.

Whenever the controller 40 detects that a location in the B section of the page selection memory 150 has a higher selection frequency value than an entry in the A section, those two entries are swapped over. If any of the selection frequency values reaches the maximum value which can be stored in the page selection memory 150, then the controller 40 decrements some or all of the selection frequency values stored in the A section.

The page selection memory 150 requires significantly less storage space than the page selection memory 30, whilst still allowing page numbers which have not previously been selected by the user to gain a place in the list of most frequently selected pages.

While the invention has been described with reference to the teletext receiver shown in Figure 1, the invention could equally be embodied as a teletext decoder operable to receive teletext data already demultiplexed from a video signal. Also, although a hardware implementation of the invention has been described, other embodiments may comprise a general purpose data processing apparatus operating under the control of suitable computer software.

3.   A receiver according to claim 1 or claim 2, comprising:
    means for detecting whether one or more of the selection
frequency values is equal to a predetermined maximum value; and
    means, responsive to a detection that one or more of the
5   selection frequency values is equal to the maximum value, for
decrementing at least some of the selection frequency values.

4.   A receiver according to claim 3, in which the means for
decrementing comprises means for decrementing all of the selection
10 frequency values stored in the means for storing.

5.   A receiver according to claim 3, in which the means for
decrementing comprises means for decrementing those selection frequency
values stored in the means for storing which are within a predetermined
15 range of the maximum value.

6.   A receiver according to any one of the preceding claims,
comprising means for storing a list comprising the predetermined number
of most frequently selected page identifiers and respective storage
20 flags indicating whether the teletext page corresponding to each page
identifier in the list has been stored in the page memory.

7.   A receiver according to claim 6, comprising:
    means for controlling storage in the page memory of a currently
25 demultiplexed teletext page having a page identifier identical to a
page identifier in the list of page identifiers; and
    means for setting the storage flag associated with that page
identifier to indicate that the currently demultiplexed teletext page
has been stored in the page memory.
30

8.   A receiver according to any one of the preceding claims, in which
each of the page identifiers comprises a page number and a television
channel number.

35 9.   A receiver according to claim 10, in which the selection
frequency detecting means is operable to detect the predetermined
number of most frequently selected page identifiers for a currently

selection of corresponding page identifiers, the method comprising the steps of:

storing, in a memory having a first memory section and a second memory section each having a plurality of entries, each entry being operable to store a page identifier and a selection frequency value associated with that page identifier, information indicative of the relative frequency of user selection of the page identifiers;

detecting a predetermined number of most frequently selected page identifiers;

storing teletext pages corresponding to the most frequently selected page identifiers;

detecting whether a teletext page corresponding to a page identifier selected by the user is stored in the page memory; and

in response to user selection of a page identifier for which the corresponding teletext page is stored in the page memory, retrieving that teletext page from the page memory for display;
the step of storing comprising:

in response to user selection of a page identifier stored in an entry in the first memory section or the second memory section, incrementing the selection frequency value associated with the selected page identifier;

in response to user selection of a page identifier not stored in an entry in the first memory section or the second memory section, storing that page identifier in an entry in the second memory section, to overwirte the least recently stored page identifier in the second memory section; and

in response to a detection that an entry in the first memory section has a lower selection frequency value than an entry in the second memory section, exchanging that entry in the first memory section with that entry in the second memory section.

12.   A teletext receiver substantially as hereinbefore described with reference to Figures 1 and 3 of the accompanying drawings.

13.   A teletext decoder substantially as hereinbefore described with reference to Figures 1 and 3 of the accompanying drawings.